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Finding the Critical Cue: Implementation Intentions to Change One's Diet Work Best When Tailored to Personally Relevant Reasons for Unhealthy Eating

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Implementation intentions promote acting on one's good intentions. But does specifying where and when to act also suffice when goals involve complex change that requires not merely initiating a behavior but rather substituting a habit with a new response? In a pilot study and two experiments, the authors investigated the efficacy of implementation intentions to replace unhealthy snacks with healthy snacks by linking different types of cues for unhealthy snacking (if-part) to healthy snacking (then-part). The pilot study identified cues for unhealthy snacking, differentiating between situational (where/when) and motivational (why) cues. Studies 1 and 2 tested the efficacy of implementation intentions that specified either situational or motivational cues in altering snacking habits. Results showed that implementation intentions specifying motivational cues decreased unhealthy snack consumption whereas the classic specification of where and when did not. Extending previous research, for complex behavior change "why" seems more important than "where and when."

Keywords: *implementation intentions; critical cues; eating behavior; habits; snacking*

People often fail to act on their good intentions (Webb & Sheeran, 2006). Research on implementation intentions shows that a specific planning of one's goals can be an effective tool in bridging this so-called intention-behavior gap (e.g., Orbell, Hodgkins, & Sheeran, 1997; Sheeran & Orbell, 1999). So far, most studies that applied implementation intentions in the health domain primarily focused on health-protective behaviors, such

as cancer screening or increasing vitamin C intake (Gollwitzer & Sheeran, 2006). Implementing these types of behaviors may be relatively straightforward as they mainly require the initiation of a desired response (e.g., attending a cancer screening or taking a vitamin C tablet). Much less research is available on the role of implementation intentions in altering health-risk behaviors such as smoking, excess alcohol consumption, or eating unhealthily (Gollwitzer & Sheeran, 2006).

These latter types of health behavior may be much more complicated to change as they require the suppression of an undesired response (e.g., quitting smoking) and sometimes even the substitution of the unwanted response with a wanted response (e.g., eating an apple instead of a candy bar).

Following a suggestion made by Gollwitzer and Sheeran (2006), we argue that more research is needed that investigates the beneficial effects of implementation intentions in changing health-risk behaviors. Consequently, the present research addresses the effectiveness of implementation intentions in decreasing unhealthy snack consumption and replacing this with more healthy eating patterns. In doing so, we employ an

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approach in which person-specific if-then patterns, that is, personal triggers for unhealthy snacking, are used as a basis for the formation of implementation intentions.

IMPLEMENTATION INTENTIONS

For a wide range of health behaviors, such as giving up smoking (D'Onofrio, Moskowitz, & Braverman, 2002), taking up regular physical exercise (Milne, Orbell, & Sheeran, 2002), or maintaining a low-fat diet (Armitage, 2004), individuals regularly experience difficulties in translating their behavioral intentions into action. Having a goal intention in these domains is generally insufficient to ensure enacting a desired behavior (Armitage & Conner, 2001; Webb & Sheeran, 2006). According to Gollwitzer (1999), in addition to forming goal intentions, implementation intentions—or plans concerning where, when, and how one will perform the intended behavior—are required to ensure behavioral enactment.

Whereas goal intentions merely specify the end state one wants to obtain (e.g., “I intend to eat healthily”), implementation intentions stipulate the time, place, and manner in which this goal will be achieved (e.g., “If I come home from work hungry in the evening, then I will eat an apple”), thereby creating an association between a specific situation and a desired behavioral response. As implementation intentions specify a particular opportunity for action (i.e., time and place), individuals are more likely to recognize this situation as a good opportunity to act. Moreover, since the situation is believed to become automatically linked to a specific behavior as a result of forming implementation intentions, one no longer has to decide in situ about which goal-directed behavior to perform when the opportunity to behave in a desired way arises. Consequently, when the specified situation (“coming home from work hungry in the evening”) is encountered, the behavior (“eating an apple”) is thought to be elicited automatically (Gollwitzer, 1999).

Implementation intentions have been found to promote several health-related behaviors, such as attending cervical cancer screening (Sheeran & Orbell, 2000) or breast screening (Rutter, Steadman, & Quine, 2006), performing breast self-examination (Orbell et al., 1997), increasing vitamin C intake (Sheeran & Orbell, 1999), resuming functional activity after joint-replacement surgery (Orbell & Sheeran, 2000), exercising (Milne et al., 2002; Prestwich, Lawton, & Conner, 2003; Rise, Thompson, & Verplanken, 2003), and eating healthily (Armitage, 2004; De Nooijer, De Vet, Brug, and De Vries, 2006; Kellar & Abraham, 2005; Verplanken & Faes, 1999).

The majority of these studies, however, were concerned with health-promoting behaviors that require

initiating a desired response (e.g., eating more fruits or vegetables) rather than *changing* an existing behavioral pattern (e.g., eating an apple instead of a candy bar; Gollwitzer & Sheeran, 2006). Replacing behavioral responses is generally more difficult than initiating new behavior or supporting ongoing responses (Holland, Aarts, & Langendam, 2006), especially when the old behavior is habitual (Webb & Sheeran, 2006). However, sometimes substituting an undesirable behavioral response is required. For example, when dieting to lose weight, one is not so much concerned with increasing fruit intake as with replacing unhealthy snacks, such as crisps or chocolate, with healthy snacks, such as fruits or vegetables.

So far, several studies on implementation intentions and eating behavior have been conducted, but to the best of our knowledge, only two studies were concerned with changing existing eating patterns (Armitage, 2004; Verplanken & Faes, 1999). A study by Verplanken and Faes (1999) showed that participants who had made implementation intentions ate more healthily than participants in the control condition who had not made such specific plans. However, although this study yielded promising results, it did not provide clear evidence that participants actually replaced unhealthy foods with healthy foods, as the implementation intentions were targeted at eating behavior for 1 day only and the results specified a composite score for the health-related quality of consumed foods, which could reflect a decrease in fatty foods, an increase in fruit and/or vegetable intake, or both.

A study by Armitage (2004) specifically addressed the reduction of fat consumption and showed that total fat intake, saturated fat intake, and the percentage of energy derived from fat significantly decreased among participants who had made implementation intentions but not among participants in the no-treatment control condition. However, the dependent measure in this study (food frequency list) relied on participants' ability to remember their food intake for a whole month, which may have resulted in considerable memory bias. It therefore remains to be determined whether these results hold under more stringent conditions. The present study aims to address the lack of pertinent data by testing a novel approach that is designed to direct the formation of implementation intentions to existing if-then profiles in order to change participants' eating behavior.

USING EXISTING IF-THEN PATTERNS IN IMPLEMENTATION INTENTIONS

Habits and implementation intentions are thought to instigate similar automatic responses that differ only in origin, that is, whether they are the result of repeated

action (i.e., habits) or reflect conscious planning (i.e., implementation intentions; cf. Aarts & Dijksterhuis, 2000). Several authors have suggested that when attempting to alter existing behavior patterns, implementation intentions could be used to link a new, desired behavior to the critical cue that previously triggered the habitual, unwanted response (Gollwitzer, 1999; Gollwitzer & Sheeran, 2006; Holland et al., 2006). If a person is familiar with his or her “situation-behavior profile” (Gollwitzer & Sheeran, 2006) and thus knows which cues elicit the undesired response, this information can be used to tailor the formation of implementation intentions to these critical cues.

Following this line of reasoning, implementation intentions may be used not only to initiate a new response but also to *override* old, habitual responses. To illustrate, if a person wants to eat more healthily and is aware that she or he always eats crisps when watching television, this knowledge could be used to link the critical cue (“watching television”) to a new, desired response (e.g., “eating an apple”), resulting in the following implementation intention: “If I am watching television and I want to eat something, then I will eat an apple.” In this way, “implementation intentions that specify the critical stimulus and link it to a response in line with the new goal should block the automatic initiation of the habitual response” (Gollwitzer, 1999, p. 500). Subsequently, when the critical cue is encountered, both the old habitual response and the new preferred response will be activated and compete for action initiation. Given that the cue-action link that is formed by the implementation intention is more recent than the habitual if-then pattern, the action stipulated in the implementation intention is assumed to have a good chance of overruling the habitual response (Holland et al., 2006).

Holland and colleagues (2006) tested this assumption in a study on recycling habits. Participants in the implementation intention condition were asked to plan where, when, and how they were going to recycle their used plastic cups and wastepaper and to visualize and write down these plans. Results showed that implementation intentions were indeed effective in breaking the old habit of throwing plastic cups and wastepaper into the bin and in creating the new habit of recycling these items.

In the present study a similar strategy will be applied to promote change in eating behaviors, in particular, the consumption of snacks. A snack is defined as any type of food that is consumed between meals (De Graaf, 2006). Our focus on snacking as the type of eating behavior to be targeted by implementation intentions was based on two reasons. First, implementation intentions should be targeted to a specific goal (such as snacking) instead of to a more general goal (such as eating) in order for the newly planned response to effectively compete with the

old habitual response (Holland et al., 2006). Second, a focus on snacking was deemed relevant because previous studies have consistently demonstrated that snack consumption is an important contributor to overweight (De Graaf, 2006; Jahns, Siega-Riz, & Popkin, 2001; Zizza, Siega-Riz, & Popkin, 2001).

CUES FOR UNHEALTHY SNACKING

Although the results reported by Holland and colleagues (2006) are promising, it remains to be determined whether the approach presented above can also be applied to more complex behaviors such as unhealthy snacking. Whereas disposing of cups seems to be directly triggered by the situational context (the presence of an empty cup), unhealthy snacking is a complex type of behavior as it does not seem to be directly linked to specific situational cues such as times or places (De Graaf, 2006) and occurs for a variety of reasons.

The literature on emotional eating, for example, suggests that for some individuals having negative emotions is a reason for the consumption of snacks (e.g., Conner, Fitter, & Fletcher, 1999; Dubé, LeBel, & Lu, 2005). Other studies suggest that people adjust their eating patterns to their perception of the social situation in which eating occurs (Herman & Polivy, 2005). In addition, a study by Jackson, Cooper, Mintz, and Albino (2003) showed that individuals report four distinct types of motivations for eating, including coping with negative affect, being social, complying with others' expectations, and enhancing pleasure.

In contrast to implementation intentions targeted at initiating new behaviors that require the specification of *any* cue that reflects a good opportunity to act, for implementation intentions to be effective in breaking habits it is essential that the if-part of the implementation intention specifies the cue that actually triggers the behavior to be substituted. For the behavior of disposing of plastic cups, this critical trigger is simply the presence of the situational cue “empty plastic cup”; as for the habit of throwing cups in the bin, the situation in itself represents the reason for performing the behavior.

However, as unhealthy snacking in general does not seem to be directly related to specific situational cues, for this type of behavior it seems of vital importance to specify the reason why the behavior is performed in order to capture the critical cue-behavior link. To illustrate, although a person who often eats unhealthy snacks to be social (e.g., eating a homemade cake that is kindly offered to you at a party, or having some of the snacks that friends ordered when you are out having a beer together) might in many cases be with friends when this occurs, “friends” may not represent the *critical* cue

for eating unhealthy snacks. This person might, for example, not eat unhealthy snacks when attending class together with friends, and a social gathering with colleagues from work will also trigger snacking, despite no friends being around.

Considering that for unhealthy snacking the reasons for performing the behavior may not consistently overlap with specific situational cues, we believe that in order to truly tackle the unwanted habit, the reasons for performing the behavior (“why”) should be considered next to traditional situational cues reflecting time and place. Throughout this article, we will refer to these two different types of cues as *situational cues* (“where/when”) and *motivational cues* (“why”).

As these motivational cues for eating unhealthy snacks probably reflect internal states or subjective cues (e.g., being bored or feeling sad) and are thus different from the objective situational cues that are traditionally used in implementation intention research, a first necessary step after identifying these motivational cues would be to investigate if they can be effectively used in implementation intentions. If motivational cues are consistently related to unhealthy snacking and can in fact be used in the if-part of implementation intentions, we expect these implementation intentions specifying the motivational underpinnings for unhealthy snacking to be more effective in altering snacking behavior than implementation intentions specifying situational cues.

RESEARCH OVERVIEW

A pilot study and two experimental studies were conducted to investigate whether making implementation intentions can help individuals to alter their snacking behavior. More specifically, we tested which type of cue (situational or motivational) can be most successfully used in implementation intentions aimed at replacing the consumption of unhealthy snacks with healthy snacks.

The pilot study was concerned with determining situational cues coinciding with unhealthy snacking as well as motivational cues reported for unhealthy snacking. As the motivational cues often reflected more internal, subjective states and very little is known about the effectiveness of implementation intentions specifying these types of internal cues, Study 1 tested the assumption that motivational cues for unhealthy snacking from our pilot study could be successfully used in implementation intentions. As such, Study 1 examined whether this distinct type of if-then plans affected healthy snacking to the same extent as implementation intentions using situational cues related to unhealthy snacking. Study 2 then compared the effectiveness of implementation intentions reflecting *personally relevant* motivational cues and situational

cues on the increase of healthy snacking as well as the decrease of unhealthy snacking, thus, providing a full test of our assumption that implementation intentions specifying the personal reasons for the unwanted behavior (motivational cues) in the if-part are able to actually replace old snacking habits.

PILOT STUDY: SITUATIONAL AND MOTIVATIONAL CUES FOR UNHEALTHY SNACKING

Method

Participants. Participants were female students recruited at the Utrecht Business and Management School. Fifty females aged 17-25 years were initially recruited, and 43 students completed the study. Four underweight participants (BMI [Body Mass Index = Weight/Height × Height] < 18) were excluded from the analysis because underweight (and obese) people might differ from normal weight and overweight people in the way they regulate their eating behavior and can be considered to have a pathological relation to food (i.e., Mela, 2006; Nasser, 2001; Vaidya & Malik, 2008). There were no obese people in the sample. The final sample consisted of 39 women with a BMI ranging from 18.3 to 27.0 ($M = 21.3$, $SD = 2.2$).

Procedure. Upon recruitment, participants were informed that the objective of the study was to gain insight into female students’ snacking behavior and that their responses would remain anonymous. The study consisted of keeping a 1-week food diary that was administered to examine where, when, and why people regularly eat unhealthy snacks. All participants received detailed instructions on how to use the diary and made an individual appointment to return their diary. When the diary had been completed, participants were debriefed and reimbursed with €5.

Food diary. In the food diary, participants were requested to record the unhealthy snacks they ate during each of 7 consecutive days. Six entries of snacking behavior were possible for each day. The instructions stated that participants were supposed to fill out one entry for each occasion (defined as a 30-min period) they were eating something unhealthy between meals and not for each separate consumption of an unhealthy snack. Healthy snacks did not have to be reported. In this manner, the frequency of episodes of unhealthy snacking and the corresponding situational and motivational cues could be determined.

Entries for each unhealthy snacking episode encompassed five types of responses to describe the details of

TABLE 1: Most Often Reported Situational and Motivational Cues for Unhealthy Snacking

Place	Situational Cues		Motivational Cues
	Activity	Company	
Home (<i>M</i> = 7.5, <i>SD</i> = 4.0)	Chatting (<i>M</i> = 3.5, <i>SD</i> = 2.8)	Alone (<i>M</i> = 5.0, <i>SD</i> = 3.5)	Appetite (<i>M</i> = 5.3, <i>SD</i> = 3.2)
School (<i>M</i> = 2.8, <i>SD</i> = 2.4)	Watching television (<i>M</i> = 3.3, <i>SD</i> = 3.2)	Friends (<i>M</i> = 4.3, <i>SD</i> = 3.1)	Enjoyment (<i>M</i> = 2.0, <i>SD</i> = 1.9)
On a visit (<i>M</i> = 1.1, <i>SD</i> = 1.5)	Studying (<i>M</i> = 2.3, <i>SD</i> = 2.3)	Family (<i>M</i> = 3.1, <i>SD</i> = 2.7)	Feeling bored (<i>M</i> = 1.9, <i>SD</i> = 2.0)
Work (<i>M</i> = 1.1, <i>SD</i> = 1.5)	Relaxing (<i>M</i> = 1.9, <i>SD</i> = 1.9)	Classmates (<i>M</i> = 1.8, <i>SD</i> = 1.8)	To be social (<i>M</i> = 1.8, <i>SD</i> = 1.9)

NOTE: Means and standard deviations reflect the average frequency with which an option was registered in a diary.

the snack consumption, using precoded alternatives as well as an “other” option. The five types of responses referred to the *nature and amount* of the unhealthy snacks that were consumed (e.g., 1 candy bar and 2 pieces of cake); the objective situational cues associated with unhealthy snacking, including the *places* (e.g., home), *activities* (e.g., studying), and *company* (e.g., friends) related to the specific instance of snacking; and the *motivational cues* (perceived reasons) for snacking (e.g., feeling bored).

Labels for motivational cues reported for unhealthy snacking reflected the four categories of motivations for eating (coping, social, compliance, and pleasure) described by Jackson et al. (2003). Examples of motivational cues are feeling bored, to be social, politeness, and enjoyment. These types of psychological motivations for eating are well documented in the eating literature (e.g., Arnow, Kenardy, & Agras, 1995; Conger, Conger, Costanzo, Wright, & Matter, 1980; Herman & Polivy, 2005; Hill, Weaver, & Blundell, 1991; Lowe & Butryn, 2007; Van Strien, Schippers, & Cox, 1995).

Results and Discussion

Descriptives. Participants consumed unhealthy snacks on average 14.9 times per week (*SD* = 6.0). As the unhealthy snacks that participants consumed varied considerably in size and calories, the mean amount of kilocalories (kcal) derived from unhealthy snacks was estimated by multiplying each reported snack by the average amount of kilocalories it contains (based on guidelines by the Dutch Nutrition Centre, <http://www.caloriechecker.nl>, and validated by a professional dietician). The mean amount of kilocalories per day derived from unhealthy snacks was 404 (*SD* = 277).

Diary. As can be seen in Table 1, participants were often at home when eating unhealthy snacks. However, when they were not at home, the most often mentioned locations were at school, on a visit, or at work. The

activities that were most often associated with eating unhealthy snacks were chatting, watching television, studying, and relaxing. Furthermore, participants were often alone when they consumed unhealthy snacks, but when they had company they most often were with friends, family, or classmates. The motivational cues for eating that were most often reported were having an appetite, enjoyment, feeling bored, and to be social.

STUDY 1: USING MOTIVATIONAL CUES IN IMPLEMENTATION INTENTIONS

Study 1 was designed to test whether the reported motivational cues for unhealthy snacking that were deemed important in the pilot study could be successfully applied in the formation of implementation intentions. So far, little is known about the efficacy of using cues that do not reflect objective, external situations, such as specific times or places, in implementation intentions (for an exemption, see Achtziger, Gollwitzer, & Sheeran, 2008). As very few studies have used internal or less objective cues, Study 1 was necessary in order to see whether the motivational cues participants reported in the pilot study could be used as cues in the if-part of implementation intentions in a similar way as traditional situational cues.

Study 1 had three conditions: one control condition and two experimental conditions (implementation intentions specifying either situational or motivational cues). For each of the two experimental conditions, two possible cues were used, as we wanted to make sure that any results would not be due to a specific cue that would work better or worse, but rather to the nature of the cue (situational cues vs. motivational cues). In each of the experimental conditions, half of the participants were therefore assigned to the first cue and the other half of the participants to the second cue of the condition they were in. Our main analysis will concern a one-way analysis of variance for the three conditions, but

we will also test the five separate conditions to check for possible differences between the two cues within the situational cue and motivational cue conditions.

In the first experimental condition, situational cues reflecting time and place as are traditionally used in implementation intention research were specified. For half of the participants in this condition, this situation was being alone, and for the other half in this condition, it was being at home, since these were the two situational cues that were most often linked to unhealthy snacking in the diaries of the pilot study.

In the second experimental condition, motivational cues for unhealthy snacking were used as triggers in the if-part of the implementation intentions. For half of the participants in this condition, the cue that was used was “to be social,” and for the other half the cue was “feeling bored.” These were the most often reported reasons for unhealthy snacking in our pilot study after “having an appetite,” which was an integral part of all implementation intentions specified (see below) and very close after “enjoyment.” We chose “to be social” and “feeling bored,” instead of “enjoyment,” as we wanted to have two motivational cues that were equally specific, and enjoyment seems more general than to be social or feeling bored.

To summarize, participants were randomly assigned to either “alone,” “at home,” “social,” “bored,” or to the control condition. However, in our first analysis the two situational cues are taken together (alone and at home) as well as the two motivational cues (social and bored).

In the experimental conditions, the cues described above were linked to the consumption of a healthy snack by means of implementation intentions. Based on recent evidence indicating that not only traditional external cues but also internal states such as feeling exhausted or feeling self-abandoned can be effectively used in the if-part of implementation intentions (Achtziger et al., 2008), it was hypothesized that both the situational (being at home and being alone) and the motivational (to be social and feeling bored) cues would be effective cues to initiate healthy snack consumption.

Method

Participants. Participants were female students (aged 18-25 years) from Utrecht University who, upon recruitment, responded positively to the question “Do you want to eat more healthily?” A total of 127 female students were recruited, and 118 participants completed the study. After excluding 4 underweight participants (BMI < 18), 5 obese participants (BMI > 30), and 1 participant who failed to indicate her weight, for similar reasons as in the pilot study, the final sample consisted of 108 participants with a BMI ranging from 18.1 to 29.2 ($M = 21.3$, $SD = 2.1$).

Procedure. Upon recruitment, participants were randomly assigned to one of the two experimental conditions in which they were asked to make implementation intentions to eat a healthy snack or to the control condition in which participants made no implementation intentions. Depending on the experimental condition, implementation intentions specified either a situational cue (being alone or being at home) or a motivational cue (feeling bored or to be social). After answering several questions regarding age, weight, height, and motivation to eat healthily (“How motivated are you to eat more healthily?” on a 7-point scale), participants received a food diary. Procedures regarding instructions, returning the diaries, debriefing, and reimbursement were similar to those in the pilot study.

Implementation intentions. Participants in the experimental conditions were told that scientific research had shown that nearly every woman has a tendency to eat unhealthy snacks when she is alone/at home/feeling bored/acting social—depending on the specific experimental condition. Subsequently, participants were informed that planning beforehand to eat a healthy snack at that specific occasion can help one to eat more healthily. Participants were then asked to choose a healthy snack they liked and that was readily accessible to them, followed by completing the statement “If I am [alone/at home/feeling bored/acting social] and I feel like having a snack, then I will take a(n). . . .” After sentence completion was verified by the experimenter, participants were told that this type of planning would work best when they would picture the specific situation in their minds (Taylor, Pham, Rivkin, & Armor, 1998). Participants were then encouraged to visualize acting out their plan for a couple of minutes.

Food diary. The food diary was similar to the food diary in the pilot study and included 7 days for which participants were asked to register the snacks they consumed. The only difference from the pilot study was that participants were asked to register their unhealthy as well as healthy snack consumption. Each entry involved one column with 12 types of unhealthy snacks and one column with 13 types of healthy snacks. For both healthy and unhealthy snacks, an “other” option was also provided. The dependent variables were the average amounts of healthy and unhealthy snacks consumed per day. The healthy snacks were summed whereas the amount of unhealthy snacks consumed was, for similar reasons as in the pilot study, expressed in kilocalories.

Results

Descriptives. On average, participants consumed 1.7 healthy snacks per day ($SD = 1.2$; 73% of which were

TABLE 2: Average Intake of Healthy (Sum) and Unhealthy (kcal) Snacks per Day

	<i>Situational Cue</i> n = 45	<i>Motivational Cue</i> n = 39	<i>Control</i> n = 24
Healthy snacks			
M	1.6	2.1	1.1
SD	1.1	1.4	0.7
Unhealthy snacks			
M	217	207	194
SD	141	156	140

fruits and vegetables), and the mean amount of calories consumed from unhealthy snacks per day was 209 kcal ($SD = 147$). Participants were on average very motivated to eat more healthily ($M = 5.2$, $SD = 1.0$), and this motivation did not differ between the three study conditions (implementation intention with situational cue, implementation intention with motivational cue, or control), $F(2, 105) = .43$, $p = .65$.

Type of cue. A multivariate analysis of variance (MANOVA) was performed on healthy snack consumption and unhealthy snack consumption (in kilocalories) with study condition as an independent variable, the results of which are depicted in Table 2. The multivariate test revealed a significant effect of condition, Wilks's Lambda $F(4, 208) = 3.08$, $p < .05$. However, univariate tests indicated that the effect of study condition was significant for healthy snacking, $F(2, 105) = 5.84$, $p < .01$, but not for unhealthy snacking, $F(2, 105) = .20$, $p = .82$.

A two-tailed Dunnett post hoc test was subsequently performed to test our hypothesis and to specifically compare the two experimental conditions with the control condition. This revealed that for healthy snacking, implementation intentions specifying motivational cues differed significantly from the control group (mean difference [MD] = 1.0, $p < .01$) while implementation intentions specifying situational cues did not ($p = .12$). Participants in the motivational cue condition consumed significantly more healthy snacks than did participants in the control condition.¹

When the analyses were performed for each type of cue separately (with five conditions), the multivariate test revealed a significant effect, Wilks's Lambda $F(8, 204) = 2.52$, $p < .05$, and the univariate tests also gave a significant effect for healthy snacking, $F(4, 103) = 4.86$, $p < .01$, but not for unhealthy snacking, $F(4, 103) = .12$, $p = .98$. The Dunnett test showed that the implementation intentions specifying the cue "to be social" resulted in a significant increase in healthy snacking, $MD = 1.1$, $p < .01$, as well as the implementation intentions specifying the cues "feeling bored," $MD = .9$, $p < .05$, and "being alone," $MD = 1.0$, $p < .05$.

Discussion

Study 1 shows that subjective motivational cues can be successfully used in the if-part of implementation intentions to promote healthy snacking. More specifically, our results demonstrate that implementation intentions specifying motivational cues for performing the unwanted behavior are effective in promoting healthy snacking, whereas implementation intentions specifying situational cues were not effective. However, when analyzing the five conditions separately, one of the situational cues (being alone) does show a significant effect on healthy snacking, indicating that for initiating healthy snacking, situational cues can probably be effectively used in implementation intentions aimed to promote initiation of a certain behavior. This latter finding is also more in line with the meta-analytical evidence for the effectiveness of specifying when and where to act in implementation intentions for health-promoting behaviors (e.g., Gollwitzer & Sheeran, 2006).

Although the implementation intentions specifying motivational cues for snacking were effective in increasing the frequency of healthy snacking, the frequency of unhealthy snacking remained unaffected. It is important to note, however, that because the aim of Study 1 was to test the assumption that subjective motivational cues can be effectively used in implementation intentions, participants were randomly assigned to one of four cues related to unhealthy snacking. As participants were not allowed to choose between different cues, the cue used in the formation of implementation intentions did not necessarily reflect individuals' *personally* most relevant trigger for unhealthy snacking.

Triggers for snacking are most likely very personal, and someone who snacks when feeling bored might not necessarily snack when she or he is feeling sociable. As it is essential for *substituting* unhealthy snacking with healthy snacking that the cues used in the implementation intentions are habitually related to eating unhealthy snacks (Holland et al., 2006), the efficacy of implementation intentions on diminishing unhealthy snacking should increase when participants are able to use their own personally most relevant cues for unhealthy snacking.

STUDY 2: MAKING CUES PERSONAL

A third study was designed to test if personally relevant motivational cues for unhealthy snacking are more effective than personally relevant, traditional situational cues when forming implementation intentions to decrease unhealthy snacking. In order to test this, participants in the two experimental conditions were asked to form an

implementation intention using either their own personally most relevant motivational cue or their own personally most relevant situational cue, depending on the experimental condition they were assigned to.

In addition, we added an active control condition as participants in the control condition performed a task about healthy eating, which was not the case in Study 1. Participants in the active control condition were told that in order to help them eat more healthily we wanted them to think about which healthy snacks they liked and to list their 10 favorite healthy snacks. By doing so we are able to eliminate the possibility that effects of making implementation intentions were caused by mere active thinking about healthy eating. It was hypothesized that although Study 1 showed that situational and motivational cues can both be effective in *initiating healthy snacking*, for *decreasing unhealthy snacking*, only personally relevant motivational cues and not personally relevant situational cues will be effective. This hypothesis was built on our assumption that in order to break habits, one needs to target the critical cue that triggers the unwanted behavior, and for snacking these critical cues generally do not reflect specific times or places, as explained in the introduction.

Method

Participants. Participants were female students recruited at the Utrecht College of Social Work. Participants were included in the study if they responded positively to the question “Are you motivated to eat more healthily?” Ninety-four participants received a food diary, and 82 participants returned their diaries. After excluding 2 underweight participants ($BMI < 18$), 2 obese participants ($BMI > 30$), 5 participants who had specified an unhealthy snack (e.g., cookie) in their implementation intention, and 1 participant who was an outlier on healthy snack consumption ($>3.5 SD$), the final sample consisted of 72 students with a BMI ranging from 18.3 to 29.4 ($M = 22.5$, $SD = 2.6$).

Procedure. Participants were randomly assigned to one of two experimental conditions (implementation intentions specifying situational cues or implementation intentions specifying motivational cues) or to the control condition. Participants in the experimental conditions were asked to form an implementation intention, and participants in the control condition were asked to list their favorite healthy snacks. Subsequently, the food diary was handed out. Procedures regarding instructions, returning the diaries, debriefing, and reimbursement were similar to those in Study 1.

Implementation intentions. Participants in all conditions were told that we were interested in helping people

to eat more healthily and that most people eat too many unhealthy snacks. On top of this, participants in the experimental conditions were instructed to choose a situation in which they generally ate unhealthy snacks and plan to eat something healthy whenever they found themselves in that specific situation. They were told to choose this cue from a list of six situational cues related to unhealthy snacking or from a list of six motivational cues for unhealthy snacking, which were provided on a form, and to pick the cue that was for them most often related to unhealthy snacking. The list’s content depended on the study condition: The list in the condition focusing on situational cues reflected the three most often mentioned places (at home, at school, on a visit) and company (alone, with friends, with family) as reported in the pilot study. Similarly, the list in the condition focusing on motivational cues consisted of those reasons for unhealthy snacking found to be of importance in the pilot study (to be social, feeling bored, enjoyment, politeness, distraction, because other people are eating).

Next, participants were asked to choose a healthy snack that they would eat whenever they were in the situation they had chosen and felt like having a snack. They were told to pick a snack that they really liked and that was usually available in the situation they chose. When they had chosen a specific healthy snack, participants were asked to complete the following sentence: “If I [situational cue or motivational cue] and I feel like having a snack, then I will take a [healthy snack].” After sentence completion was verified by the experimenter, participants were, as in Study 1, told that their plan would be most effective when they would picture the specific situation in their minds (Taylor et al., 1998) and were encouraged to visualize acting out their plan for a few minutes.

Food diary. The food diary differed from the diary in the second study only in that it consisted of one entry for healthy and unhealthy snacks per day instead of filling out the diary for each snacking occasion. By simplifying data recording this way, participants no longer had to complete the diary several times a day but could instead aggregate their snack consumption in one entry for the full day, making the study less demanding. The dependent variables were similar to Study 1.

Results

Descriptives. Participants consumed on average 1.6 healthy snacks ($SD = 1.0$; 75% of which were fruits and vegetables) and 220 kcal ($SD = 141$) of unhealthy snacks per day. Participants were, as in Study 1, highly motivated to eat more healthily, as measured by the item “How motivated are you to eat more healthily?” on a 7-point scale ($M = 5.6$, $SD = 0.8$). Motivation did not

TABLE 3: Average Intake of Healthy (Sum) and Unhealthy Snacks (kcal) per Day

	<i>Situational Cue</i> n = 24	<i>Motivational Cue</i> n = 27	<i>Control</i> n = 21
Healthy snacks			
M	1.6	1.9	1.2
SD	0.7	1.2	0.9
Unhealthy snacks			
M	217	183	273
SD	121	137	155

differ between the three conditions, $F(2, 69) = .76$, $p = .47$.

Type of cue. A MANOVA was performed on the dependent variables, with condition (implementation intention with situational cue, implementation intention with motivational cue, or control) as the independent variable. The multivariate test revealed a significant effect of condition, Wilks's Lambda $F(4, 136) = 2.63$, $p < .05$. Univariate tests indicated that the effect of condition was significant for healthy snacking, $F(2, 69) = 3.15$, $p < .05$, and marginally significant for unhealthy snacking, $F(2, 69) = 2.56$, $p = .08$. The means and standard deviations for healthy and unhealthy snacking for the three conditions are presented in Table 3.

To examine our hypothesis that implementation intentions specifying personal motivational cues for snacking are effective in reducing the consumption of unhealthy snacks and increasing the consumption of healthy snacks, a two-tailed Dunnett post hoc t test was performed. This test revealed that for healthy snacking, the motivational cue condition did indeed differ significantly from the control condition ($MD = 0.74$, $p < .05$), with participants in this condition eating on average 0.74 more healthy snacks per day than participants in the control condition. The situational cue condition did not differ significantly from the control condition, $p = .31$. For unhealthy snacking, the Dunnett t test also showed that the motivational cue condition differed significantly from the control condition ($MD = 90$, $p < .05$): The mean daily consumption of unhealthy snacks in this group was 90 kcal lower than for participants in the control condition. The situational cue condition did not differ significantly from the control condition on unhealthy snacking ($p = .29$).²

Discussion

Study 2 examined whether people replace unhealthy snacks with healthy snacks when they specify their personal motivational cue for unhealthy snacking in implementation intentions. Confirming our expectations, findings showed that implementation intentions resulted

in a lower consumption of unhealthy snacks and a higher consumption of healthy snacks only when the if-part specified the underlying personal motivational cue for unhealthy snacking. When personal situational cues that may coincide with unhealthy snacking, but are not the critical triggers, were used as the cue in the if-part of the plan, the habitual response was not replaced.³

GENERAL DISCUSSION

Thus far, research on implementation intentions in the health domain has focused mainly on health-promoting behaviors (e.g., cancer screening) that require the initiation of a new behavior (Gollwitzer & Sheeran, 2006). However, it has been suggested that when implementation intentions link the critical stimulus that typically elicits the habitual response to a new, desired response, they could also be effective in changing (habitual) behavior (Gollwitzer, 1999; Gollwitzer & Sheeran, 2006; Holland et al., 2006). Previously, Holland and colleagues (2006) showed that this approach was effective in altering recycling behavior. The present study aimed to test whether this approach could also be applied to more complex behavior, such as unhealthy snacking, that occurs in diverse circumstances and for numerous reasons (De Graaf, 2006; Jackson et al., 2003). It was expected that this approach would work, but only if the cues specified in the implementation intentions concerned motivational cues for the undesired behavior instead of external situational cues as unhealthy snacking was not expected to be triggered by simple context cues. We conducted a pilot and two studies to examine this hypothesis.

The pilot study was designed to identify the situational and motivational cues for unhealthy snacking. Study 1 then tested these cues for their effectiveness in implementation intentions and showed that implementation intentions specifying motivational cues (i.e., feeling bored and socializing) for unhealthy snacking were effective in promoting healthy snacking, whereas traditional implementation intentions that specified situational cues (i.e., being alone and being at home) were not. However, when analyzing the data for each of the cues separately, feeling bored, socializing, and being alone all proved to be effective cues for initiating healthy snacking.

Although forming implementation intentions using three of the four cues promoted the consumption of healthy snacks, no effects were found for unhealthy snacking in Study 1. Apparently, participants ate more healthy snacks, but these healthy snacks did not replace unhealthy snacks. This implies that we probably did not succeed in specifying the critical triggers for unhealthy snacking. As triggers for unhealthy snacking differ

substantially between individuals, in Study 2, implementation intentions were tailored to target participants' most relevant personal motivational or situational cues for unhealthy snacking. In this manner, we expected to truly target the critical cues.

Based on the rationale proposed in the introduction, it was expected that specifying personal motivational cues, but not personal situational cues, in implementation intentions would result in a decreased consumption of unhealthy snacks. The second study indeed revealed that when participants were asked to link their personal motivational cues for unhealthy snacking to a healthy alternative by means of implementation intentions, they consumed significantly more healthy snacks and fewer unhealthy snacks compared to participants in the control condition. This indicates that the formation of implementation intentions based on personal motivational cues was successful in promoting behavior change by substituting unhealthy snacks for healthy snacks.

Our finding that implementation intentions specifying motivational cues were effective in decreasing unhealthy snack consumption when participants were allowed to specify their personally most relevant cue and thus their truly critical cue, but not when participants were assigned a cue, is in line with recent evidence indicating that implementation intentions are more effective in an autonomy-supportive manner (Koestner et al., 2006).

The reported findings extend prior research on implementation intentions in several ways. First of all, the present study tested the efficacy of implementation intentions in altering existing behavior patterns, whereas most studies in the health domain have focused merely on the initiation of health-promoting responses. The results from the present study support the proposition that implementation intentions can be effective in changing health-risk behaviors that require the substitution of an unwanted response with a wanted response (e.g., Gollwitzer, 1999). Second, the results support the notion that existing if-then patterns can be used to break unwanted habits by linking the critical stimulus (e.g., feeling bored) that normally elicits the undesired response (e.g., eating chocolate) to the new, desired response (e.g., eating an apple) and is, to our knowledge, the first to apply this strategy to a more complex goal (i.e., snacking).

Finally, the present line of research revealed that not only external cues but also internal motivational cues can be used in the if-part of implementation intentions. In this respect, the present study replicates earlier work by Achtziger et al. (2008), who already showed that implementation intentions can be successful in shielding goal striving from detrimental inner states by specifying responses that can alleviate the disruptive influence of these states.

Most important, however, the present study also extends new work on implementation intentions, such as the work by Achtziger et al. (2008), as it is the first to try to identify the truly critical cues by specifically comparing the efficacy of implementation intentions specifying either traditional situational cues such as being at home or inner motivational triggers such as feeling bored in the if-part of the plan. This comparison shows that *only* implementation intentions specifying personally relevant motivational cues for the behavior to be substituted yielded a significant decrease in unhealthy snack consumption, whereas implementation intentions specifying external situational cues related to unhealthy snacking did not.

This finding supports our earlier assumption that for breaking habits regarding complex goals such as snacking, it may be more important to consider why an undesired behavior is performed rather than where and when it is performed. The present findings have some important implications as they suggest that for more complex behavioral change it may even be essential to specify the reasons that underlie the behavior to be substituted rather than the external cues that coincide with this behavior. For some simple behaviors, such as throwing away an empty cup, the underlying reason might be rather straightforward as it overlaps with the presence of a certain situational cue (e.g., an empty cup). However, for more complex behaviors, such as snacking, it seems necessary to make a distinction between the situational circumstances and the critical trigger that causes the unwanted behavior to occur or, in other words, the personal reason for the unwanted behavior. As the present research concerns only one type of behavior (i.e., snacking), the most important questions that need answering based on the present findings seem to be which type of cue would be more important for different types of goals and whether there may be some benefit to combining the two types of cues.

In addition to their theoretical relevance, the presented findings also have important social implications. The World Health Organization reported in 2005 that more than 1 billion adults worldwide were overweight. Considering that being overweight is a major risk factor for heart diseases, stroke, type 2 diabetes, and other chronic diseases (Visscher & Seidell, 2001), it is important to find strategies that can help to decrease the consumption of foods that cause individuals to become overweight. As Hill, Wyatt, Reed, and Peters (2003) reported that weight gain in most populations can be effectively prevented by relatively small but consistent changes in behavior that result in a decrease in caloric intake of 100 kcal, the present findings are rather promising. Our study has shown that one easily made implementation intention that targeted a single critical cue for unhealthy snacking already resulted in an average

reduction of 90 kcal per day in energy intake from unhealthy snack consumption.

Limitations and Future Directions

Although this study provides some promising results, it also has several limitations, the most obvious one being that it included only women. Second, findings are based on self-reported snacking behavior, and previous studies have shown that individuals have a tendency to underreport their caloric intake (e.g., Muhlheim, Allison, Heshka, & Heymsfield, 1998; Rennie, Coward, & Jebb, 2007). However, even though using an objective measure of eating behavior may increase the validity of the results, food diaries are among the most sophisticated naturalistic eating measures that are currently available (De Castro, 2000).

A further limitation concerns the short period of time, 1 week, in which snacking behavior was reported. As Holland and colleagues (2006) argue, two requirements need to be met before concluding that implementation intentions can break habits: (a) The change in behavior needs to be lasting and stable, and (b) the link between past behavior and future behavior is consistently reduced. Future research should hence measure snacking behavior for a longer period as well as before and after forming implementation intentions in order to further insight into the effectiveness of the presently used approach in changing snacking habits. Future research should also be concerned with using participants' own idiographic set of motivational cues instead of allowing participants to choose from a list of cues as this would result in more personally relevant cues, which could benefit the efficacy of the implementation intentions.

Additionally, despite the fact that in Study 2 implementation intentions specifying motivational cues were effective when compared to a control condition, but traditional implementation intentions specifying situational cues were not, we were not able to statistically show that the two types of implementation intentions differed significantly from each other. Future research should replicate our findings, using more participants, to ensure a large enough power to test whether the implementation intentions specifying motivational cues are superior to the implementation intentions specifying situational cues. Finally, as mentioned earlier, it would be particularly interesting to examine whether our approach using personal motivational cues would also be successful in altering other types of complex habitual behaviors and to investigate which type of cue works better for different goals.

Conclusions

To summarize, the present study shows that personal if-then patterns can be used to form implementation intentions aimed at breaking existing behavioral patterns.

In addition, the present study stresses that in the case of more complex behaviors such as snacking, these if-then patterns should reflect personal motivational cues for the undesired behavior rather than situational cues associated with the behavior. To alter more complex behaviors, it appears to be more informative to find out why the behavior is performed than to identify the situational circumstances related to the behavior.

NOTES

1. For Study 1, the results are similar when the number of unhealthy snacks is entered into the analyses instead of unhealthy snacks in terms of kilocalories. The Dunnett *t* test again shows no significant effects for unhealthy snacking.

2. For Study 2, the pattern of results is similar when the number of unhealthy snacks is entered into the analyses instead of unhealthy snacks in terms of kilocalories. The Dunnett *t* test shows a marginally significant effect for unhealthy snacking for the implementation intentions specifying motivational cues, $MD = 6.9$, $p < .08$, but no effect for the implementation intentions specifying situational cues, $p = .42$.

3. Extra data collection showed that the ineffectiveness of situational cues was not due to a lack of specificity, as was suggested by one of the anonymous reviewers. When situational cues were made more specific by adding a time of the day (morning, afternoon, or evening) to the chosen situational cue, the analyses again revealed no significant difference in healthy snack consumption ($p = .50$) nor in unhealthy snack consumption ($p = .90$) for the situational cue condition compared to the control condition. The data also again indicated a beneficial effect of specifying motivational cues as people in the motivational cue condition consumed on average 0.5 more healthy snacks ($p < .05$) and 125 kcal less of unhealthy snacks ($p < .05$) per day than people in a control condition.

REFERENCES

- Aarts, H., & Dijksterhuis, A. (2000). Habits as knowledge structures: Automaticity in goal-directed behavior. *Journal of Personality and Social Psychology*, 78, 53-63.
- Achtziger, A., Gollwitzer, P. M., & Sheeran, P. (2008). Implementation intentions and shielding goal striving from unwanted thoughts and feelings. *Personality and Social Psychology Bulletin*, 34, 381-393.
- Armitage, C. J. (2004). Evidence that implementation intentions reduce dietary fat intake: A randomized trial. *Health Psychology*, 23, 319-323.
- Armitage, C. J., & Conner, M. (2001). Efficacy of the theory of planned behaviour: A meta-analytic review. *British Journal of Social Psychology*, 40, 471-499.
- Arnou, B., Kenardy, J., & Agras, W. S. (1995). The Emotional Eating Scale: The development of a measure to assess coping with negative affect by eating. *International Journal of Eating Disorders*, 18, 79-90.
- Conger, J. C., Conger, A. J., Costanzo, P. R., Wright, K. L., & Matter, J. A. (1980). The effect of social cues on the eating behavior of obese and normal subjects. *Journal of Personality*, 48, 258-271.
- Conner, M., Fitter, M., & Fletcher, W. (1999). Stress and snacking: A diary study of daily hassles and between-meal snacking. *Psychology and Health*, 14, 51-63.
- De Castro, J. M. (2000). Eating behavior: Lessons from the real world of humans. *Nutrition*, 16, 800-813.
- De Graaf, C. (2006). Effects of snacks on energy intake: An evolutionary perspective. *Appetite*, 47, 18-23.
- De Nooijer, J., De Vet, E., Brug, J., & De Vries, N. K. (2006). Do implementation intentions help to turn good intentions into higher fruit intakes? *Journal of Nutrition Education and Behavior*, 38, 25-29.

- D'Onofrio, C. N., Moskowitz, J. M., & Braverman, M. T. (2002). Curtailing tobacco use among youth: Evaluation of Project 4-Health. *Health Education and Behavior, 29*, 656-682.
- Dubé, L., LeBel, J. L., & Lu, J. (2005). Affect asymmetry and comfort food consumption. *Physiology and Behavior, 86*, 559-567.
- Gollwitzer, P. M. (1999). Implementation intentions: Strong effects of simple plans. *American Psychologist, 54*, 493-503.
- Gollwitzer, P. M., & Sheeran, P. (2006). Implementation intentions and goal achievement: A meta-analysis of effects and processes. *Advances in Experimental Social Psychology, 38*, 69-119.
- Herman, C. P., & Polivy, J. (2005). Normative influences on food intake. *Physiology and Behavior, 86*, 762-772.
- Hill, A. J., Weaver, C. F. L., & Blundell, J. E. (1991). Food craving, dietary restraint and mood. *Appetite, 17*, 187-197.
- Hill, J. O., Wyatt, H. R., Reed, G. W., & Peters, J. C. (2003). Obesity and the environment: Where do we go from here? *Science, 299*, 853-855.
- Holland, R. W., Aarts, H., & Langendam, D. (2006). Breaking and creating habits on the working floor: A field-experiment on the power of implementation intentions. *Journal of Experimental Social Psychology, 42*, 776-783.
- Jackson, B., Cooper, M. L., Mintz, L., & Albino, A. (2003). Motivations to eat: Scale development and validation. *Journal of Research in Personality, 37*, 297-318.
- Jahns, L., Siega-Riz, A. M., & Popkin, B. M. (2001). The increasing prevalence of snacking among US children from 1977 to 1996. *Journal of Pediatrics, 138*, 493-498.
- Kellar, I., & Abraham, C. (2005). Randomized controlled trial of a brief research-based intervention promoting fruit and vegetable consumption. *British Journal of Health Psychology, 10*, 543-558.
- Koestner, R., Horberg, E. J., Gaudreau, P., Powers, T., Di Dio, P., Bryan, C., et al. (2006). Bolstering implementation plans for the long haul: The benefits of simultaneously boosting self-concordance or self-efficacy. *Personality and Social Psychological Bulletin, 32*, 1547-1558.
- Lowe, M. R., & Butryn, M. L. (2007). Hedonic hunger: A new dimension of appetite? *Physiology and Behavior, 91*, 432-439.
- Mela, D. J. (2006). Eating for pleasure or just wanting to eat? Reconsidering sensory hedonic responses as a driver of obesity. *Appetite, 47*, 10-17.
- Milne, S., Orbell, S., & Sheeran, P. (2002). Combining motivational and volitional interventions to promote exercise participation: Protection motivation theory and implementation intentions. *British Journal of Health Psychology, 7*, 163-184.
- Muhlheim, L. S., Allison, D. B., Heshka, S., & Heymsfield, S. B. (1998). Do unsuccessful dieters intentionally underreport food intake? *International Journal of Eating Disorders, 24*, 259-266.
- Nasser, J. (2001). Taste, food intake and obesity. *Obesity Reviews, 2*, 213-218.
- Orbell, S., Hodgkins, S., & Sheeran, P. (1997). Implementation intentions and the theory of planned behavior. *Personality and Social Psychological Bulletin, 23*, 945-954.
- Orbell, S., & Sheeran, P. (2000). Motivational and volitional processes in action initiation: A field study of the role of implementation intentions. *Journal of Applied Social Psychology, 30*, 780-797.
- Prestwich, A., Lawton, R., & Conner, M. (2003). The use of implementation intentions and the decision balance sheet in promoting exercise behaviour. *Psychology and Health, 18*, 707-721.
- Rennie, K. L., Coward, A., & Jebb, S. A. (2007). Estimating under-reporting of energy intake in dietary surveys using an individualised method. *British Journal of Nutrition, 97*, 1169-1176.
- Rise, J., Thompson, M., & Verplanken, B. (2003). Measuring implementation intentions in the context of the theory of planned behavior. *Scandinavian Journal of Psychology, 44*, 87-95.
- Rutter, D. R., Steadman, L., & Quine, L. (2006). An implementation intentions intervention to increase uptake of mammography. *Annals of Behavioral Medicine, 32*, 127-134.
- Sheeran, P., & Orbell, S. (1999). Implementation intentions and repeated behaviour: Augmenting the predictive validity of the theory of planned behaviour. *European Journal of Social Psychology, 29*, 349-369.
- Sheeran, P., & Orbell, S. (2000). Using implementation intentions to increase attendance for cervical cancer screening. *Health Psychology, 19*, 283-289.
- Taylor, S. E., Pham, L. B., Rivkin, I. D., & Armor, D. A. (1998). Harnessing the imagination: Mental simulation, self-regulation, and coping. *American Psychologist, 53*, 429-439.
- Vaidya, V., & Malik, A. (2008). Eating disorders related to obesity. *Therapy, 5*, 109-117.
- Van Strien, T., Schippers, G. M., & Cox, W. M. (1995). On the relationship between emotional and external eating behavior. *Addictive Behaviors, 20*, 585-594.
- Verplanken, B., & Faes, S. (1999). Good intentions, bad habits, and effects of forming implementation intentions on healthy eating. *European Journal of Social Psychology, 29*, 591-604.
- Visscher, T. L. S., & Seidell, J. C. (2001). The public health impact of obesity. *Annual Review of Public Health, 22*, 355-375.
- Webb, T. L., & Sheeran, P. (2006). Does changing behavioral intentions engender behavioral change? A meta-analysis of the experimental evidence. *Psychological Bulletin, 132*, 249-268.
- World Health Organization. (2005, September 22). *The World Health Organization warns of the rising threat of heart disease and stroke as overweight and obesity rapidly increase*. Retrieved September 7, 2007, from <http://www.who.int/mediacentre/news/releases/2005/pr44/en/index.html>
- Zizza, C., Siega-Riz, A. M., & Popkin, B. M. (2001). Significant increase in young adults' snacking between 1977-1978 and 1994-1996 represents a cause for concern! *Preventive Medicine, 32*, 303-310.

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